

High Efficiency Microchannel Diamond Heat Sinks, Phase I

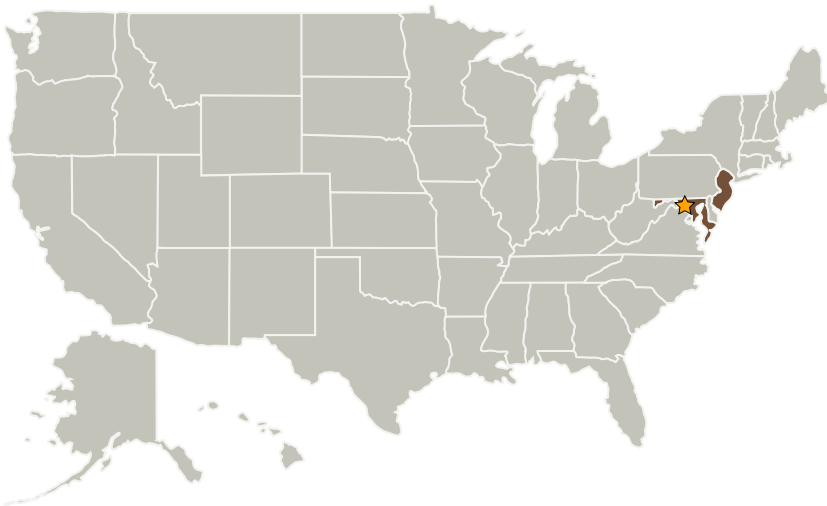
Completed Technology Project (2006 - 2006)



Project Introduction

While absolute power levels in microelectronic devices are relatively modest (a few tens to a few hundred watts), heat fluxes can be significant (~ 50 W/cm² in current electronic chips; up to 2000 W/cm² in semiconductor lasers). Microchannel diamond heat sinks created via microfabrication techniques make it possible to boost heat transfer rates well above what is possible with ordinary cooling devices. If nanodiamond particles are added in suspension to the circulating fluid in the microchannels, the heat carrying properties of the device would be increased even more. The devices we are proposing to fabricate would utilize diamond which has the highest thermal conductivity of any known material combined with a microchannel cooling system. These unique attributes would make microchannel diamond heat sinks prime contenders for the next generation heat sink. These devices could be utilized for efficient cooling in a variety of applications requiring high heat transfer capability including: semiconductor lasers, multichip modules in computers laser-diode arrays, radar systems, high-flux optics, etc. An added benefit for outer space applications is that besides having the highest known thermal conductivity, diamond is the best shielding material for micrometeorite protection.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Diamond Materials, Inc.	Supporting Organization	Industry Small Disadvantaged Business (SDB)	East Stroudsburg, Pennsylvania

Primary U.S. Work Locations

Maryland	New Jersey
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Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.2 Thermal Control Components and Systems
 - └ TX14.2.2 Heat Transport